14:35:31 OCA PAD INITIATION - PROJECT HEADER INFORMATION 05/28/90

Active

Project #: B-10-A14 Cost share #: Rev #: 0
Center # : 10/24-6-R6500-0B4 Center shr #: OCA file #: 126
Work type : RES
Contract#: F33615-87-D-0626-0014 Mod #: Document : DO
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: OIP Unit code: 03.010.106
Project director(s):
TOLER J C OIP (404)894-3964

Sponsor/division names: AIR FORCE / WRIGHT-PATTERSON AFB, OH
Sponsor/division codes: 104 / 002

Award period: 900514 to 910314 (performance) 910514 (reports)

Sponsor amount	New this change	Total to date
Contract value	56,076.00	56,076.00
Funded	56,076.00	56,076.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: LATE IMMUNOBIOLOGICAL EFFECTS OF SPACE RADIATION

PROJECT ADMINISTRATION DATA

OCA contact: E. Faith Gleason 894-4820

Sponsor technical contact

DR ANN B COX
(512)536-3416

USAFSAM/RZB
BROOKS AFB TX 78235-5301

Sponsor issuing office
SEND TRANSMITTAL LETTER
JEFFREY H MELLOTT

(513)255-5616
ASD/PMRSC
WRIGHT-PATTERSON AFB OH 45433-6503

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : DO-C9 GOVT supplemental sheet
Equipment title vests with: Sponsor X GIT

* Administrative comments -
INITIATION. SUBCONTRACTOR EXPECTED TO BE TRINITY UNIVERSITY.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 06/16/92

Project No. B-03-A14_____ Center No. 10/24-6-R6500-0B4_

Project Director TOLER J C_____ School/Lab BEC_____

Sponsor AIR FORCE/WRIGHT-PATTERSON AFB, OH_____

Contract/Grant No. F33615-87-D-0626-0014_____ Contract Entity GTRC

Prime Contract No. _____

Title LATE IMMUNOBIOLOGICAL EFFECTS OF SPACE RADIATION_____

Effective Completion Date 910314 (Performance) 910514 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	Y	_____
Government Property Inventory & Related Certificate	Y	_____
Classified Material Certificate	N	_____
Release and Assignment	Y	_____
Other _____	N	_____

Comments_____
_____

Subproject Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other _____	N
_____	N

NOTE: Final Patent Questionnaire sent to PDPI.

B-10-A19

SR690

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-10-A00/R6500

Period Covered: May 01, 1990 through May 31, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-10-A00/R6500

Period Covered: June 01, 1990 through June 30, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

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Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B03-A04

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: July 01, 1990 through July 31, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

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Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: August 01, 1990 through August 31, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

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Georgia Institute of Technology
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Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: September 01, 1990 through September 30, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

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Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: October 01, 1990 through October 31, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: November 01, 1990 through November 30, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

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Atlanta, Georgia 30332-0259

B03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: December 01, 1990 through December 31, 1990
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: January 01, 1991 through January 31, 1991
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 0.00
Management Fee (7.5% of Total Costs)	$ 0.00	$ 0.00
TOTAL	$ 0.00	$ 0.00

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: February 01, 1991 through February 28, 1991
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 25,706.74	$ 25,706.74
Management Fee (7.5% of Total Costs)	$ 1,928.01	$ 1,928.01
TOTAL	$ 27,634.75	$ 27,634.75

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

CERTIFICATE OF SERVICES/RESEARCH
CONTRACT NO. F33615-87-D-0626
GEORGIA TECH NO. B-03-A00/R6500

Period Covered: March 01, 1991 through March 31, 1991
Delivery Order No. 0014

I. DIRECT COSTS:

	Current	Cumulative
Subcontracts (Trinity University)	$ 0.00	$ 25,706.74
Management Fee (7.5% of Total Costs)	$ 0.00	$ 1,928.01
TOTAL	$ 0.00	$ 27,634.75

"I certify that the above is a true and correct statement of efforts performed under Contract No. F33615-87-D-0626 by the Georgia Institute of Technology through the Georgia Tech Research Corporation for the subject time period."

James C. Toler, Project Director

The above statement is approved for payment by the Government.

Ann B. Cox

Cruz Cantu

Please forward approved "certificate" to:

Georgia Institute of Technology
Grants and Contracts Accounting
Attn: Sandi Chestnut
Atlanta, Georgia 30332-0259

B-03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

November 12, 1990

James C. Toler, Director
Bioelectromagnetics Laboratory
Co-Director, Bioengineering Center
(404) 894-3964

Norberto F. Ezquerra, Director
Medical Informatics Laboratory
(404) 894-7026

Philip R. Kennedy, Director
Neuroscience Laboratory
(404) 894-4257

Michael J. Sinclair, Director
Robotics and Microelectronics Laboratory
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KEY STAFF

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Michael F. Burrow
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Wesley W. Shelton, Jr.
(404) 894-8727

Thomas G. Single
(404) 894-7033

Crystal L. Tucker
(404) 894-7022

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 1, Sequence No. 13, for the Reporting Period 14 May through 30 June 1990

Gentlemen:

Please find attached the May/June 1990 Performance and Cost Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 05/14/90 - 06/30/90

For the month ending 06/30/90

Principal Investigator Salary	1,013.50
Research Assoc. (Research Tech Sec.)	0.00
UTHSC-Salaries	0.00
Student Labor	0.00
Fringe Benefits	107.31
Supplies	0.00
Travel	0.00
Other Costs	0.00
IDC-10% MTDC-(UTHSC)	0.00
TOTALS	$ 1,120.81

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts

Principal Investigator

B03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

November 12, 1990

James C. Toler, Director
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Co-Director, Bioengineering Center
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Medical Informatics Laboratory
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Neuroscience Laboratory
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Thomas G. Single
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Crystal L. Tucker
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DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report (Cumulative) No. 1, Sequence No. 14, for the Reporting Period 14 May through 31 August 1990

Gentlemen:

Please find attached the 14 May/31 August 1990 Performance and Cost Report (Cumulative) for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 05/14/90 - 08/31/90

	For the month ending 08/31/90	Cumulative
Principal Investigator Salary	0.00	2,027.00
Research Assoc. (Research Tech Sec.)	0.00	0.00
UTHSC-Salaries	0.00	0.00
Student Labor	0.00	0.00
Fringe Benefits	0.00	208.64
Supplies	32.52	32.52
Travel	0.00	0.00
Other Costs	57.25	57.25
IDC-10% MTDC-(UTHSC)	0.00	
TOTALS	$ 89.77	$2,325.41

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts Principal Investigator

B03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

November 12, 1990

James C. Toler, Director
Bioelectromagnetics Laboratory
Co-Director, Bioengineering Center
(404) 894-3964

Norberto F. Ezquerra, Director
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DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 2, Sequence No. 13, for the Reporting Period 1 July through 31 July 1990

Gentlemen:

Please find attached the July 1990 Performance and Cost Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 07/01/90 - 07/31/90

For the month ending 07/31/90

Principal Investigator Salary	1,013.50
Research Assoc. (Research Tech Sec.)	0.00
UTHSC-Salaries	0.00
Student Labor	0.00
Fringe Benefits	101.33
Supplies	0.00
Travel	0.00
Other Costs	0.00
IDC-10% MTDC-(UTHSC)	0.00
TOTALS	$ 1,114.83

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts

Principal Investigator

B03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0200

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

November 26, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 3, Sequence No. 13, for the Reporting Period 1 August through 31 August 1990

Gentlemen:

Performance on the Task Order was subcontracted to Dr. William H. Stone in the Department of Biology at Trinity University in San Antonio, TX. Dr. Stone did not submit a separate Performance and Cost Report for the August 1990 time period; however, he did provide performance and cost information in the Cumulative Performance and Cost Report for the time period May through August 1990. Dr. Stone will be contacted to determine whether it is feasible to prepare and submit a monthly Performance and Cost Report for a time period approximately 18 months ago.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

B-03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

November 12, 1990

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Co-Director, Bioengineering Center
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Medical Informatics Laboratory
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DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 4, Sequence No. 13, for the Reporting Period 1 September through 30 September 1990

Gentlemen:

Please find attached the September 1990 Performance and Cost Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 09/01/90 - 09/30/90

For the month ending 09/30/90

Principal Investigator Salary	0.00
Research Assoc. (Research Tech Sec.)	687.50
UTHSC-Salaries	0.00
Student Labor	0.00
Fringe Benefits	117.61
Supplies	5,513.25
Travel	0.00
Other Costs	0.00
IDC-10% MTDC-(UTHSC)	0.00
TOTALS	$ 6,318.36

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts

Principal Investigator

B-03-A14

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

BIOENGINEERING CENTER
404•894•3964
FAX: 404•894•3120

February 27, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 5, Sequence No. 13, for the Reporting Period 1 October through 31 October 1990

Gentlemen:

Please find attached the October 1990 Performance and Cost Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone
Dr. Ann Cox, USAFSAM/RZB

James C. Toler, Director
Bioelectromagnetics Laboratory
Co-Director, Bioengineering Center
(404) 894-3964

Norberto F. Ezquerra, Director
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Thomas G. Single
(404) 894-7033

Crystal L. Tucker
(404) 894-7022

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 10/01/90 - 10/31/90

FEB 26 1991

For the month ending 10/31/90

Principal Investigator Salary	0.00
Research Assoc. (Research Tech Sec.)	0.00
UTHSC-Salaries	5,608.00
Student Labor	197.60
Fringe Benefits	525.47
Supplies	206.25
Equipment	0.00
Travel	41.76
Other Costs	300.00
IDC-10% MTDC-(UTHSC)	642.88
TOTALS	$ 7,521.96

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts

Principal Investigator

B03 - A14

Georgia Tech

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November 26, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Cumulative Performance and Cost Report No. 2, Sequence No. 14, for the Reporting Period 1 September through 30 November 1990

Gentlemen:

Performance on the Task Order was subcontracted to Dr. William H. Stone in the Department of Biology at Trinity University in San Antonio, TX. Dr. Stone did not submit a separate Cumulative Performance and Cost Report for the September-November 1990 time period. He will be contacted through the Contracts/Grants Office at Trinity University to determine if is feasible to prepare and submit a Cumulative Performance and Cost Report at this time.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

B03-A14

Georgia Tech

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November 26, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 6, Sequence No. 13, for the Reporting Period 1 November through 30 November 1990

Gentlemen:

Performance on the Task Order was subcontracted to Dr. William H. Stone in the Department of Biology at Trinity University in San Antonio, TX. Dr. Stone did not submit a separate Performance and Cost Report for the November 1990 time period; however, he did provide performance and cost information in the Cumulative Performance and Cost Report for the time period September through November 1990. Dr. Stone will be contacted to determine whether it is feasible to prepare and submit a monthly Performance and Cost Report for a time period approximately 18 months ago.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

B-03-A14

Georgia Tech

Georgia Institute of Technology
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400 Tenth Street, N.W.
Atlanta, Georgia 30332-0130

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February 27, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report No. 7, Sequence No. 13, for the Reporting Period 1 December through 31 December 1990

Gentlemen:

Please find attached the December 1990 Performance and Cost Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone
Dr. Ann Cox, USAFSAM/RZB

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Bioelectromagnetics Laboratory
Co-Director, Bioengineering Center
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P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 12/01/90 - 12/31/90

FEB 26 1991

For the month ending 12/31/90

Principal Investigator Salary	0.00
Research Assoc. (Resea. Tech Sec.)	2,083.33
UTHSC-Salaries	0.00
Student Labor	0.00
Fringe Benefits	454.46
Supplies	1,745.81
Equipment	0.00
Travel	0.00
Other Costs	0.00
IDC-10% MTDC-(UTHSC)	0.00
TOTALS	$ 4,283.60

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts

Principal Investigator

B03-A14

Georgia Tech

Georgia Institute of Technology
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November 12, 1990

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report (Cumulative) Nos. 2 and 3, Sequence No. 14, for the Reporting Period December 1990 through February 1991

Gentlemen:

Performance on this Task Order was subcontracted to Dr. William H. Stone on the Biology Department at Trinity University in San Antonio, TX. Dr. Stone did not submit separate Performance and Cost Reports for the September-November 1990 and December 1990-February 1991 time periods. He will be contacted through the Contracts/Grants Office at Trinity University to determine if it is feasible to prepare and submit Cumulative Performance and Cost Reports at this time.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

B03-A14

Georgia Tech

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February 27, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Performance and Cost Report Nos. 8 and 9, Sequence No. 13, for the Reporting Periods 1 January through 31 January 1991 and 1 February through 14 February 1991

Gentlemen:

Please find attached the January and February 1991 Performance and Cost Reports for the referenced Task Order. These reports were prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone
Dr. Ann Cox, USAFSAM/RZB

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Technical Progress Report
Sub-contract B-10-A14-S1

P. I. Professor W. H. Stone
Department of Biology
Trinity University
San Antonio, TX 78212

Covering the period 01/01/91 - 02/14/91

Antibody-Mediated Immunity

We have continued to test the most recent blood samples for the three parameters, IgG, IgM, IgA, complement activity and autoantibodies.

Our preliminary analysis of the data for one set of bleedings (March, 1987) indicate that there is no detectable effect of treatment (irradiation) on any of these parameters. However, we have some indication that age may be a factor. To test this hypothesis, we have obtained blood samples from a colony of rhesus monkeys with monkeys of various ages. We are currently testing these blood samples and entering the data into a computer data file. We are fortunate in that this colony contains some monkeys whose ages are similar to the chronic bleed monkeys' ages.

Cell-Mediated Immunity

Samples on monkeys UO8, U47, U64, S53, 134A, 142A, BH6, ASO, HO4, AY4, BE2, BCO, H40, BV6, BE6 O5C, 87H, BL6, AW6, EJ4, 6AO, V88, IA2, and WO4 were received. Peripheral blood mononuclear cells were isolated by standard procedures. The following immune function assays were performed: Con A and PHA stimulation; PMA or pokeweed responses on some samples. Data is being stored in a spreadsheet data file for data analysis.

Previous data analysis showed that the proliferative abilities of peripheral blood mononuclear cells without mitogen stimulation decreased as radiation dosage increased even though there was no observable relationship between dosage and the proliferative responses to Con A or PHA mitogens. The preliminary conclusion was that exposure to radiation does in fact have a negative effect on the proliferative abilities of unactivated T and B cells in the immune systems of the monkeys studied. Additional studies on the monkeys covered in this report do not show a correlation between radiation dose and immune function. However, there may be a correlation between immune function studies and other parameters, such as total white blood cell count. Therefore, additional correlations are being examined with data stored by Dr. Cox.

B03 A14

Georgia Tech

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November 26, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. Jeffrey Mellot

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Cumulative R & D Status Report No. 1, Sequence No. 1, for the Reporting Period 1 May 1990 through 31 August 1990

Gentlemen:

Please find attached the May-August Cumulative R & D Status Report for the referenced Task Order. This report was prepared and submitted by Dr. William H. Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for this Task Order with the Department of Biology, Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

P.I. Dr. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 05/14/90 - 08/31/90

	For the month ending 08/31/90	Cumulative
Principal Investigator Salary	0.00	2,027.00
Research Assoc. (Research Tech Sec.)	0.00	0.00
UTHSC-Salaries	0.00	0.00
Student Labor	0.00	0.00
Fringe Benefits	0.00	208.64
Supplies	32.52	32.52
Travel	0.00	0.00
Other Costs	57.25	57.25
IDC-10% MTDC-(UTHSC)	0.00	
TOTALS	$ 89.77	$2,325.41

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller-Grants/Contracts Principal Investigator

B03-A14

Georgia Tech

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November 26, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Cumulative R & D Status Report Nos. 2 and 3, Sequence No. 14, for the Reporting Periods 1 September through 30 November 1990 and December 1990 through February 1991

Gentlemen:

Performance on this Task Order was subcontracted to Dr. William H. Stone in the Department of Biology at Trinity University in San Antonio, TX. Dr. Stone did not submit separate Cumulative R & D Status Reports for the September-November 1990 and December 1990-February 1991 time periods. He will be contacted through the Contracts/Grants Office at Trinity University to determine if it is feasible to prepare and submit Cumulative Performance and Cost Reports at this time.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

B03-A14

Georgia Tech

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February 27, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-10-A14

Subject : Interim Technical Report No. 1, Sequence No. 18, for the Reporting Period 14 May through 13 November 1990

Gentlemen:

Please find attached Interim Technical Report No. 1 for the performance period 14 May 1990 through 13 November 1990 for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for the Task with the Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-10-A14

cc: Dr. W. Stone
Dr. Ann Cox, USAFSAM/RZB

James C. Toler, Director
Bioelectromagnetics Laboratory
Co-Director, Bioengineering Center
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FEB 26 1991

P.I. DR. William Stone
Trinity Account Number: 525268
Subcontract Number : B-10-A14-S1
Period covered by Report: 05/14/90-11/30/90

For the month ending	11/30/90	Cumulative
Principal Investigator Salary	0.00	$ 2,027.00
Research Assco.(Research Tech)	2,083.33	2,770.83
UTHSC-Salaries	2,804.00	8,412.00
Student Labor	125.40	323.00
Fringe Benefits	2,722.18	3,573.90
Supplies	0.00	5,752.02
Travel	0.00	41.76
Other Costs	0.00	357.25
IDC-10% MTDC-(UTHSC)	378.80	1,021.68
TOTALS	$8,113.71	$24,279.44

I certify that to the best of my knowledge and belief the data above is correct and that all outlays were made in accordance with the contract conditions or other agreement.

Assistant Comptroller/Grants-Contracts

Principal Investigator

B03-A14

IN CONFIDENCE

Georgia Tech

Georgia Institute of Technology
Centennial Research Building
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October 24, 1991

DEPARTMENT OF THE AIR FORCE
Air Force Systems Command
Aeronautical Systems Division/PMRSC
Wright-Patterson AFB, OH 45433-6503

Attention: Mr. John M. Lipker

Reference: Task Order 0014 Under Contract No. F33615-87-D-0626, "Pre-Acquired Research in Biotechnology", Georgia Tech Project No. B-03-A14

Subject : Final Technical Report (Draft), Sequence No. 19, for the Reporting Period May 1990 through March 1991

Gentlemen:

Please find attached the draft version of the Final Technical Report for the referenced Task Order. This report was prepared and submitted by Dr. William Stone, the Principal Investigator on the subcontract Georgia Tech has negotiated for this Task with the Department of Biology at Trinity University in San Antonio, TX.

Sincerely,

J.C. Toler, Director
Project No. B-03-A14

cc: Dr. W. Stone, Trinity Univ.
Mr. J. Keil, USAFSAM/RZP

SUBCONTRACT NO. B-10-A14-S1

FINAL REPORT

Covering the Period 5-14-90 to 3-14-91

Late Immunobiological Effects of Space Radiation

From

Trinity University

715 Stadium Drive

San Antonio, TX 78212

Principal Investigator

Professor William H. Stone

Distinguished Professor of Biology

Trinity University

San Antonio

Collaborator

Dr. Michael Miller

Associate Professor, Pediatrics

U. T. Health Science Center

at San Antonio

Date of this Report - September 1991

Background

The colony of rhesus monkeys (Macaca mulatta) at the Brooks Air Force Base Chronic Radiation Colony (CRC) in San Antonio, Texas has been maintained for over 25 years to gather information regarding late effects of exposure to ionizing radiations. The most dramatic effects found to date have been life-shortening associated with organ degeneration, cancer, endometriosis, and opportunistic infections (Yochmowitz, et al., 1985).

Since it is well known that radiation affects the immune system, the availability of the CRC of rhesus monkeys provided a unique opportunity to study the posible immune effects of the radiation treatment. We were particularly interested in effects which would be potentially relevant to human diseases that may occur in astronauts and high-flying pilots who are exposed to radiation.

These studies actually began in 1986 but were interrupted several times because of lack of funding. the overall objectives of this study were as follows:

(1) To assess the possible effects of radiation on antibody-mediated immune (AMI) function by measuring immunoglobulin (Ig) levels, hemolytic complement activity, and autoantibodies. These parameters are associated with B-cell function.

(2) To assess the possible effects of radiation on cell-mediated immune (CMI) function by measuring selected T- and B-cell activity as well as response to mitogens and interleukin production. These parameters are associated with T-cell function.

Objective (1) was performed at Trinity University, Department of Biology, under the direction of primary investigator, Professor William H. Stone. Objective (2) was performed at the University of Texas Health Science Center under the direction of Dr. Michael L. Miller.

Preliminary Results

Early studies indicated that there were no significant effects of radiation on any of the B- or T-cell functions measured. However, since most of the monkeys were old (greater than 25 years), we initiated a study to determine if age had an effect on any of these immune parameters.

We were fortunate to be able to obtain serum samples from rhesus monkeys of various ages. We gratefully acknowledge the

University of Wisconsin Regional Primate Research Center (WRPRC), Madison, WI for its generous cooperation.

Even during the periods when we were not funded, we continued, at a caretaker's level, to collect and analyze sera obtained from the CRC monkeys. Our inventory of sera is shown in Table 1.

ASSAY OF B-CELL FUNCTION

IMMUNOLOGICAL LEVELS

Methodology The serum samples were assayed by a single radial immunodiffusion technique using commercially available (Kallestad Laboratories [now Sanofi Diagnostics Pasteur] 1000 Lake Hazeltine Drive, Chaska, MN 55318-1084) immunoplates that are routinely used for quantitative assays of human Ig levels. It seemed justified to use the human system to test the monkeys, because the major Ig classes are about 90% homologous among the various old world primate species; and because our aim was to compare the levels of Ig between the irradiated and control monkeys of different ages. The tests were set up and read at 18 and 72 h by the same operator, taking careful note of the lot number and the standard reference curves for each test kit. The samples were suitably diluted to obtain clear-cut reactions (i.e., diameters of precipitation rings). A computer program was written that converted precipitation ring diameters to international units based on the standard curve for each lot of Ig plates. IgG, IgA and IgM levels were assayed.

REPEATABILITY OF Ig ASSAY

Before analyzing the results in detail, we set up a number of experiments to determine how repeatable the radial immune assay was. The results were as follows:

Retest I

Retest I was conducted to determine the reliability of IG measurements that fell outside of the range of the standards included in the testing kit. Of the animals that had at least one IG measurement out of range, 16 were randomly selected. The blood samples of these animals were used to obtain a new reading of IGA, IGG, and IGM, at both 18 and 72 hours.

These new measurements were compared to the original measurements in two ways. First, all measurements were converted to units and correlations between the new and old measurements were computed. Second, those new measurements that had been made at the same dilution as the old measurements were compared to each other and correlations were computed. In all of these comparisons, except for IGM at 72 hours on the unit scale, the correlations were

very low and were not significantly different from zero. Some correlations were actually negative. Nine of the 16 tested animals had originally had IGM 72 hour readings that were out of the range of the standards. Comparing the new measurements for these animals (on a unit scale) with the original measurements yielded a correlation of 0.851 (p=.004).

By changing the dilutions for retest I, all of the retested values for IGA and IGG fell within the range of the standards. All of these values had originally been lower than the lowest standard, and the new values were all higher than the original values, strongly suggesting that values that fall below the lowest standard result in unit measurements that are too small.

Of the 16 values of IGM that originally fell out of the range of the standards, retesting at a new dilution brought only 4 of them into the range of the standards. Of those that had orginally fallen below the lowest standard, all of the new readings were higher (on a unit scale) than the originals. Of those that had originally fallen above the lowest standard, half had new measurements that were lower than the originals, and half higher.

The general conclusion of this test was that the observations that fell outside of the range of the standards were subject to a substantial amount of error.

Retest II

Because retest I results did not match well with the original measurements, a second retest was performed to determine if original and retest measurements matched more closely for animals whose original measurements had not fallen out of the range. Twelve such animals were randomly chosen. Additionally, 4 animals that did have outside measurements were chosen. Each of the 6 readings (IGA, IGG, IGM, all at 18 and 72 hours) was redone four times for each of these 16 animals. Two of the readings were made on plates from one lot and two on plates from another lot. Each sample was diluted separately. This experiment was designed to determine how much variability could reasonably be expected in the measurements.

An analysis was performed on the diameter readings. No significant lot-effect was found. The variability of the four measurements for a single animal was generally small. For IGA, IGG, and IGM at both 18 and 72 hours, the estimated standard deviation of the measurements for an animal was about 0.15 (diameter unit). The correlations of the four repetitions with each other were quite high (>.9).

The results of the first of the four repetitions of retest II were compared with the original measurements for the animals whose original measurements had been within the range of the standards.

These comparisons were made using International Unit measurements and, where possible, diameter measurements. The results are shown in Table 2.

Note that the IGA measurements correspond fairly closely to the original measurements in both units and diameters, while the match for IGG and IGM is less satisfactory. For the unit and diameter correlations that can be directly compared, the retested diameter measurements match the original diameter measurements just slightly better than the retested unit measurements match the retested unit measurements.

Overall conclusions from this retest are that for measurements within the range of the standards:

i) There is little change in diameter measurements from lot to lot.

ii) The estimated standard deviation for repeated measurements on the same animal is about .15 (diam.).

iii) Repeated measurements on the same animal match each other more closely than they match the original measurements. Only the match with the original IGA measurement is good.

iv) There is a very slight tendency for diameters to match the original diameters better than for units to match original units.

Retest III

A third retest was performed on the animals that were used in retest I. The purpose of this retest was to determine whether another set of recently-collected observations would correspond more closely to the original measurements or to the retest I measurements. The results of this test are summarized in Table 3 a & b.

Clearly, the measurements match the more recently calculated values more closely than the original values. The low correlation between the two retests on IGG at 18 hours seems unusual.

The so-called "original data" were obtained on samples that were stored at -70°C for a relatively short time (perhaps less than 1 year). In contrast, the retest I & II used the same samples, but they had been stored at -70°C or more than 3 years. Thus, it is possible that prolonged storage accounts in part for the poor correlation between the original data and the retest I data. The

same operator performed the original and the retests. It is possible that her technical skills improved between the time of the original tests and the retests. This seems reasonable in view of the high correlations between retests I and II. In any case, we have considerable confidence in the reliability of the results for most of the samples tested to date.

EFFECT OF RADIATION ON Ig LEVELS

It was believed that a rational way to look at the data was to group the irradiated monkeys into 4 groups according to radiation dose and whether or not the type of radiation would be expected to reach the blood-forming organs (bone marrow, spleen, liver, etc.). This decison seemed justified on 2 grounds: (1) the immunologic parameters that we were studying are elaborated by the blood-forming organs (BFO), and (2) there were too few monkeys in each of the several dose and energy radiation classes with which to carry out reliable statistical analyses.

Using this irradiation classification, we have been analyzing the data using various statistical methods. The analyses are not completed, but our preliminary results show that the irradiated monkeys show no significant differences either among the different groups or between any single group and the unirradiated controls. These preliminary results would seem to confirm our earlier analyses suggesting that there is no detectable effect of irradiation on the Ig (G, A, and M) levels in the survivor monkeys. Similar analyses of data for the other bleeding dates are underway.

(Note: Graphs depicting some of these reulsts have been reported in the final report for the period February 1989-December 1989.)

ANALYSIS OF EFFECT OF TREATMENT VS. SEX

We have not yet completed this analysis, but our preliminary data suggest no effect of treatment on sex, as might be expected from our preliminary analyses of the total population. The number and sex of the animals and the various treatments are shown in Table 5.

ANALYSIS OF EFFECT OF TREATMENT VS AGE

The AF and WRPRC data were pooled, thus adding a large number of animals to the aged group. These data are being analyzed now. Our preliminary results indicate:

i. There was no difference among the different treatments and age.

ii. There was a significant increase in the Ig levels with age as summarized in Table 6.

Although there was no significant sex difference, it appeared that the males changed more rapidly with age than the females.

EFFECT OF TREATMENT ON LEVELS OF HEMOLYTIC COMPLEMENT

Methodology The serum samples were assayed using a commercial radial immune assay. Serum is placed in wells of precise dimensions and diffuses through the agarose gel containing standardized sheep erythrocytes sensitized with hemolysin. If all complement proteins are present in sufficient quantity, the sheep red blood cells are lysed to form a clear zone ring. A reference curve is constructed on semi-logarithmic graph paper; ring diameters cleared by reference sera are plotted on a linear scale and their corresponding concentrations on the logarithmic scale. The points are connected, and unknown concentrations are determined by locating the cleared zone ring diameter of the sample on the reference curve. All tests were set up and read after 6 h by the same operator.

Results We have tested over 600 samples from the CRC animals representing 5 different bleedings over a period of 3 years (1984 to 1987). We have also tested all of the 477 samples from the WRPRC. The data have not yet been statistically analyzed, but preliminary analyses indicate no significant differences in complement activity between irradiated and control CRC monkeys. There apparently is no significant difference between the complement activity of the CRC monkeys and the monkeys from the 2 WRPRC, except for the 1984 and 1985 samples. The low complement activities in the CRC 1984-85 samples are likely the result of degradation during handling and storage.

Incidence of Autoantibodies

Methodology Serum samples were assayed using an indirect fluorescent antibody test kit (Kallestad Laboratories, now Sanofi Diagnostics, Chaska, MN). Autoantibodies in a test sample bind to homologous antigens in the substrate. Excess (unbound) serum is then removed from the substrate by washing. Fluorescein isothiocyanate (FITC) antiserum is added to the substrate and attaches to the bound autoantibody. After a second washing step to remove excess FITC, the substrate is coverslipped and viewed with a fluorescent microscope for specific fluorescent patterns which indicate the presence of autoantibodies in the test sample.

Results The results of our preliminary analysis of the autoantibody frequency in the CRC vs. treatment are shown in Table 7.

It is safe to conclude from these data that there is no significant difference in the frequency of autoantibodies in any of the treatment groups or in the control. It is interesting to note that the average frequency over all treatments including the control is 21.2%. It will be most interesting to see what the frequency is in the age-matched group of monkeys from WRPRC. Preliminary data indicate that the incidence of autoantibodies is higher in the CRC monkeys than among monkeys of other colonies.

By far, the majority (90%) of strong reactions were for anti-reticulin antibodies that are associated with celiac disease in humans (Eterman & Feltkamp, 1978). About 10% were anti-nuclear antibodies that are associated with renal disease, especially systemic lupus erythematosus (Schwartz, 1986).

ASSAY OF T-CELL FUNCTION

Exposure to radiation is known to cause a rapid decrease in the number of circulating B and T lymphocytes in humans (Yamakido, et al., 1982; Gaston, et al., 1988; Sieber, et al., 1985; Manori, et al., 1985; Trentham, et al., 1981; Fuks, et al., 1976 and Campbell, et al., 1973). The ability of these cells to proliferate in response to mitogens also decreases following radiation exposure. These conditions are often short lived, and both the number and function of human B and T cells may recover within as little as three months after exposure (Gaston, et al., 1973 and Fuks, et al., 1976). The time necessary for full recovery depends upon the amount of radiation received, the areas of the body exposed, and the age of the subject at the time of exposure.

Our preliminary results on the CRC monkeys indicate that there is no observable relationship between radiation dosage and immune function, as measured by proliferative responses to Con A, PHA, and pokeweed mitogens.

MATERIALS AND METHODS

Monkeys. A total of 106 monkeys were studied, including control monkeys who received no irradiation and monkeys that received varying amounts of radiation. (Table 8).

Isolation of Peripheral Blood Mononuclear Cells. Blood was obtained by venipuncture in tubes containing heparin. It was transported to the University of Texas Health Science Center at San Antonio. Peripheral mononuclear cells were obtained using Ficoll-Hypaque.

Cell Culturing. After adding 5 ml enriched RPMI media, the cells were adjusted to a concentration of 200,000 cells per ml and 260 ul of enriched media with cells was placed into each well of 96-well

micro titer plates. The plates were incubated at 5% CO_2 for 48 hrs. To the wells was then added 50 ul of either enriched media (control group) or the appropriate mitogen (Con A, PHA or pokeweed, usually 10 μg). After incubating for at least another 48 hours, 50 ul of tritiated thymidine (1 uCi/ml) was added 6 hours before placing the plates into a cell harvester. Filter papers containing harvested cells were placed into tubes with 2 ml of scintillation fluid to allow uniform dispersion of radioactivity. Counts per minute (CPM) were obtained in a scintillation counter. The results were analyzed using an IBM personal computer and database/spreadsheet software.

Procedure for Making Enriched RPMI Media. Enriched RPMI media was made by mixing 500 ml of RPMI media with 50 ml of fetal calf serum, 5 ml of HEPES buffer, and 5 ml of non-essential amino acids. Next was added 5 ml of L-glutamine, 5 ml of pyruvic acid, and 3.5 ml of penicillin/streptomycin. Finally, 5 x 10^5M 2-mercaptomethanol was added.

RESULTS

We examined both the actual CPM value for each monkey and the monkey's stimulation index (S.I.). The S.I. for each mitogen is that mitogen's CPM value divided by the monkey's control (no mitogen) CPM value. S.I.s allow compensation for responses that displayed excessive proliferation without mitogen stimulation. The monkeys were categorized into groups according to radiation dosages. (See Table 4).

Proliferative Responses in the Absence of a Mitogen. The average control CPM values in the absence of a mitogen are shown for each monkey in Figure 1. As more monkeys were studied, the proliferative abilities of peripheral blood mononuclear cells no longer tended to decrease as radiation dosage increased, as had been previously reported.

Proliferative Responses of Cells Stimulated by Con A. The S.I. of cells stimulated by Con A are shown in Figure 2. As can be seen, there was no observable relationship between dosage and the proliferative responses to this mitogen.

Proliferative Response of Cells Stimulated by PHA. The S.I. of cells stimulated by PHA (10 ug) which largely stimulates T-cells, are shown in Figure 3. As can be seen, there is no significant effect of irradiation dose on the S.I.

Proliferative Response of Cells Stimulated by Pokeweed Mitogen. The stimulation indexes of cells stimulated by the B-lymphocyte mitogen pokeweek 2.5 ug (PWM) are shown in Figure 4. As can be

seen, there is no observable relationship between dosage and proliferative responses to this mitogen.

DISCUSSION

Based on our preliminary data, exposure to radiation has not affected the proliferative responses of T cells to PHA or Con A in the CRC monkeys. Some drop in spontaneous proliferation was noted, which could be due to several factors. Radiation exposure may have decreased the number of cells available for proliferative responsiveness. However, studies of humans have shown that lymphocyte counts of irradiated subjects eventually recover to levels equal to or higher than those of non-irradiated control subjects (Trentham, et al., 1981 and Sado, et al., 1978). Alternatively, radiation-induced genetic defects might result in inhibition of proliferative responses. Other experiments have shown that the proliferative responses of mitogen-activated lymphocytes are significantly lower in experimental groups consisting of subjects with chromosomal aberrations, than in control groups (Yamakido, et al., 1982 and Buckton, et al., 1967). It would be interesting to examine the CRC monkeys for chromosomal abnormalities.

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TABLES

Table 1. Inventory of Sera from CRC Rhesus Monkeys

Year of Sampling	Approximate Number of Samples*	
	CRC	WRPRC
1986	441	103
1987	274	0
1988	255	374
1989	240	0
1990	95	0
1991	87	0
TOTALS	1392	477

* In 1986 there were 3 bleedings annually; thereafter, there were only 2 bleedings. The WRPRC samples were obtained over the entire year period.

Table 2. Analysis of Repeatability of Immunoglobulin Assay Results

Item	Reading*	Units			Diameter		
IG	Hr.	corr.	p	n	corr.	p	n
IGA	18	.784	.001	14			
		.965	.002	6	.976	.001	6
IGA	72	.749	.002	14			
		.928	.008	6	.932	.007	6
IGG	18	.384	.175	14	.521	.057	14
IGG	72	.381	.179	14	.402	.155	14
IGM	18	no conversion information			.517	.126	10
IGM	72	no conversion information			.539	.108	10

* Note that results on the same line pertain to the same animals.

Table 3. a. Correlation of Results of Ig Level Assays with Original Assay Results

Item Reading		Units			Diameter		
IG	Hr.	corr.	p	n	corr.	p	n
IGA	18	.222	.516	11	(dilutions differ)		
IGA	72	.333	.318	11	(dilutiions differ)		
IGG	18	.103	.826	7	.257	.579	7
IGG	72	.348	.444	7	.403	.370	7
IGM	18	**			.907	.057	7
IGM	72	.826	.006	9	(dilutions differ)		

b. Correlation with Retest I data

Item Reading		Units			Diameter		
IG	Hr.	corr.	p	n	corr.	p	n
IGA	18	.848	.000	11	.808	.008	9
IGA	72	.906	.000	11	.844	.004	9
IGG	18	.294	.522	7	.699	.122	6
IGG	72	.767	.044	7	.782	.066	6
IGM	18	**			(dilutions differ)		
IGM	72	.968	.000	9	(dilutions differ)		

** Several outlying values distort these statistics.

Table 4. Grouping of Irradiated Monkeys by Dose and Probability of Effects on Blood Forming Organs (BFO)

Group	Dose (rads)	Penetration to BFO (MeV)
1.	High dose (>200 rads)	No: (32 or 55)
2.	Low dose (<200 rads)	No: (32 or 55)
3.	High dose (>200 rads)	Yes: (138,400 or 2,300)
4.	Low dose (<200 rads)	Yes: (1138,400 or 2,300)

Table 5. Analysis of Data Comparing Irradiation Effect and Sex

GROUP / Frequency / Percent / Row Pct / Col Pct	SEX ♀	SEX ♂	Totals
BFO/High	4 0.80 23.53 1.29	13 2.60 76.47 6.84	17 3.40
BFO/Low	.15 3.00 31.25 4.84	33 6.60 68.75 17.37	48 9.60
Controls	9 1.80 28.13 2.90	23 4.60 71.88 12.11	32 .40
No BFO/High	8 1.60 34.78 2.58	15 3.00 65.22 7.89	23 4.60
No BFO/Low	1 0.20 12.50 0.32	7 1.40 87.50 3.68	8 1.60
WRPRC	273 54.60 73.39 88.06	99 19.80 26.61 52.11	372 74.40
Totals	310 62.00	190 38.00	500 100.00

Table 6. Effect of Age on Iq Levels

Iq	Increase/year Diameter	Units
A	.053	21.5
G	.026	25.5
M	.020	3.07

Table 7. RESULTS COMPARING IRRADIATION TREATMENT VS. PRESENCE OF AUTOANTIBODIES

TREATMENT / Frequency / Percent / Row Pct / Col Pct	AUTOANTIBODIES NO	YES	TOTAL
CONTROL	.26 19.70 78.79 25.00	7 5.30 21.21 25.00	33 25.00
NO BFO/High	.18 13.64 75.00 17.31	6 4.55 25.00 21.43	24 18.18
NO BFO/Low	5 3.79 62.50 4.81	3 2.27 37.50 10.71	8 6.06
BFO/High	15 11.36 83.33 14.42	3 2.27 16.67 10.71	18 13.64
BFO/Low	40 30.30 81.63 38.46	9 6.82 18.37 32.14	49 37.12
TOTAL	104 78.79	28 21.21	132 100.00

Note: Weak autoantibody has been recoded as yes

Table 8. Statistical Analyses of Data on Irradiation vs Incidence of Autoantibodies

Statistic (N=132)	Degrees of Freedom	X^2 Value	Prob.
Chi-Square	4	1.936	0.748
Likelihood Ratio Chi-Square	4	1.782	0.776
Mantel-Haenszel Chi-Square	1	0.332	0.565
PHI	-	0.121	-
Contingency Coefficient	-	0.120	-
Cramer's V	-	0.121	-

Table 9. Inventory of 106 Monkeys Assayed for T-cell Function

Number of Monkeys	Dose (rads)
32	controls
3	25
4	50-56
12	100-113
18	200-280
10	300-395
10	400-600
8	900-1000
9	1000-1500

FIGURES

Figure 1. The spontaneous proliferative abilities of PBMC from irradiated monkeys, as measured by thymidine uptake.

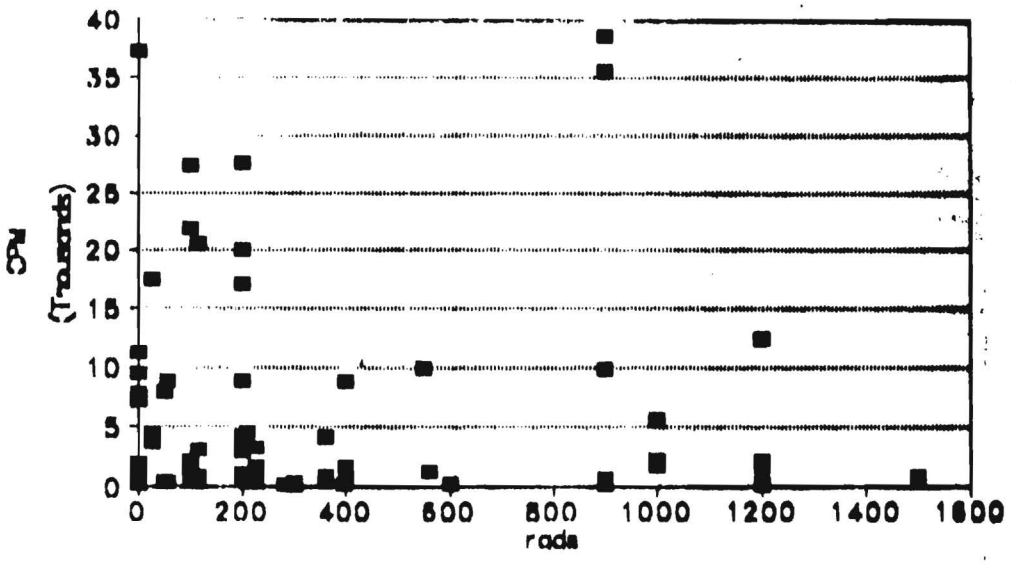

Figure 2. The proliferation of PBMC from irradiated monkeys in response to 10 ug/ml Con A, as measured by S.I.

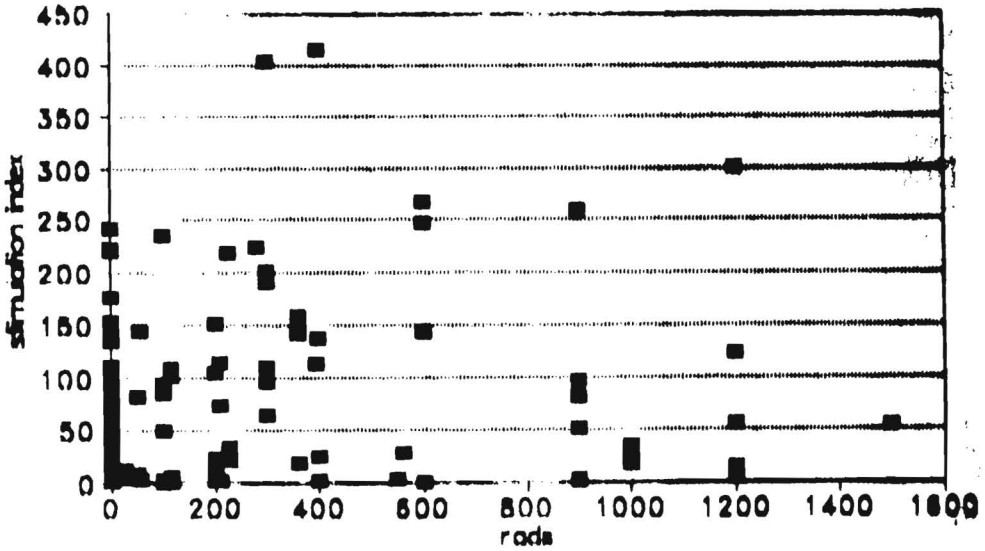

Figure 3. The proliferation of PBMC in response to 10 ug/ml PHA, as measured by S.I.

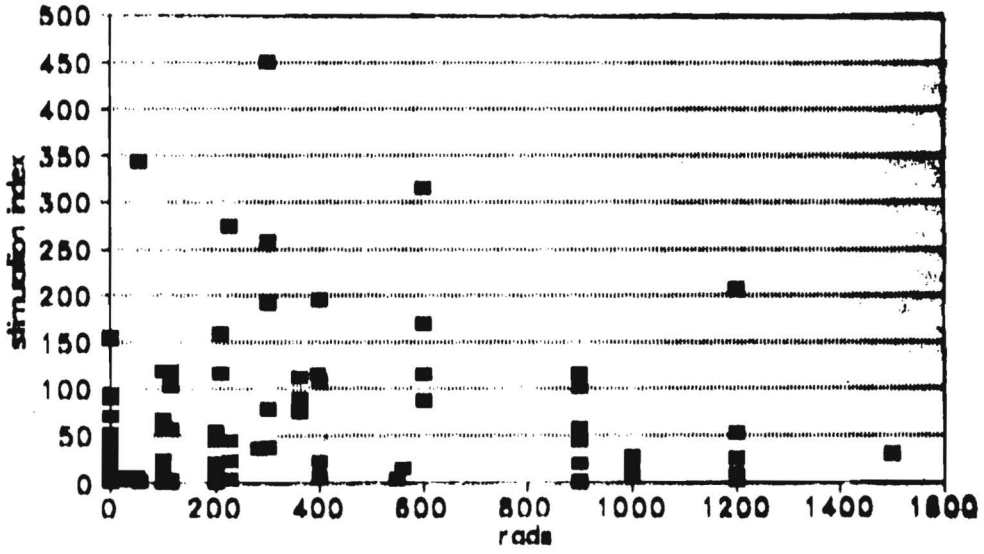

Figure 4. The proliferation of PBMC from irradiated monkeys in response to 2.5 ug/ml PHA, as measured by S.I.